Part I
6. Quality Control and Quality Assurance

6.1 Specifications

The specifications and standards listed in this Section govern the execution of Quality Control and Quality Assurance, including nondestructive testing, except as noted otherwise in this document.

6.1.1 Codes

Applicable local building code, including standards referenced by the code

6.1.2 Quality Assurance Agency Practices

ASTM E329 - *Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction*

ASTM E543 - *Standard Practice for Agencies Performing Nondestructive Testing*

ASTM E1212 - *Standard Practice for Establishment and Maintenance of Quality Control Systems for Nondestructive Testing Agencies*

6.1.3 Magnetic Particle Testing (MT)

ASTM E709 - *Standard Guide for Magnetic Particle Examination*

ASTM E1444 - *Standard Practice for Magnetic Particle Examination*

6.1.4 Ultrasonic Testing (UT)

ASTM E587 - *Standard Practice for Ultrasonic Angle-Beam Examination by the Contact Method*

ASTM E114 - *Standard Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method*

ASTM E164 - *Standard Practice for Contact Examination of Weldments*

ASTM A898 - *Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes*

ASTM A435 - *Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates*

6.1.5 Nondestructive Testing Personnel Qualification

(a) ANSI/ASNT CP-189-1995, ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel;

or

(b) ASNT Recommended Practice No. SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*, 1995

6.2 Submittals

The Quality Assurance Agency shall submit the following items:

1. Qualifications of QA Agency's management and QA personnel designated for the project,
2. QA Agency's Written Practice, as defined in Section 6.2.1,
3. Qualification records for Inspector and NDT technicians designated for the project,
4. QA Agency's NDT procedures, equipment calibration records, and personnel training records, and
5. QA Agency's Quality Control Plan for the monitoring and control of the Agency's operations.

6.2.1 Written Practice for Quality Assurance Agencies

The Quality Assurance Agency shall maintain a Written Practice for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualification and certification of inspection personnel. The Written Practice shall also describe the Agency's procedures for determining the acceptability of the structure in accordance with the applicable codes, standards, and specifications. The Written Practice shall also describe the Agency's inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.

> *Commentary: The Quality Assurance Written Practice submittals should be furnished to the fabricator and erector, to provide the parties performing the work with an understanding of the quality assurance measures that will be employed.*

6.2.1.1 Bolting Inspection Procedures

Bolting inspection procedures shall meet the requirements of the RCSC *Specification* and the Quality Assurance Plan. Inspection procedures shall be written specifically for the installation and pretensioning methods to be used, i.e. turn-of-nut method, calibrated wrench method, twist-off bolt method, or direct tension indicator method. Written procedures shall also be prepared for the arbitration of disputes, to be used should a dispute arise regarding the pretension of previously installed fasteners.

6.2.1.2 Welding Inspection Procedures

Welding inspection procedures shall meet the requirements of the *AWS D1.1* and the Quality Assurance Plan.

6.2.1.3 Shear Connector (Stud) Inspection Procedures

Shear connector inspection procedures shall meet the requirements of the *AWS D1.1* and the Quality Assurance Plan.

6.2.2 Written Practice for Nondestructive Testing Agencies

The NDT Agency shall maintain a Written Practice for the control and administration of NDT personnel training, examination and certification, describing the training, experience and examination requirements for each level of certification. The Written Practice shall describe the responsibility of each level of certification for determining the acceptability of material and weldments in accordance with the applicable codes, standards, specifications and procedures.

6.3 Inspector Qualifications

6.3.1 Special Inspector Qualifications

Special Inspectors shall be trained and competent, to the satisfaction of the party responsible for the Quality Assurance Plan, to provide the assigned special inspection tasks.

6.3.2 Welding Inspector Qualifications

All Welding Inspectors shall have adequate visual acuity, documented by vision testing performed within the past three years, in accordance with *AWS D1.1*, Section 6.1.4.4.

All Welding Inspectors shall be trained and thoroughly experienced in inspecting welding operations, and qualified in accordance with *AWS D1.1*, Section 6.1.4.

For welds in Seismic Weld Demand Categories A and B, welding inspectors shall be AWS Certified Welding Inspectors (CWI), or Senior Certified Welding Inspectors (SCWI), as defined in AWS QC1, *Standard and Guide for Qualification and Certification of Welding Inspectors*, latest edition.

For welds in Seismic Weld Demand Category C, welding inspection personnel shall be AWS Certified Associate Welding Inspectors (CAWI) or higher, or otherwise qualified under the provisions of *AWS D1.1-98*, Section 6.1.4, to the satisfaction of the party responsible for the Quality Assurance Plan.

The use of assistants in inspection operations is permitted, provided the assistants are adequately trained in their responsibilities, and are under the close supervision of the inspector responsible for the joint or connection being inspected.

The qualification of an inspector previously certified as a CWI is acceptable, although the certification may have expired, provided the inspector has remained active in the inspection of welded steel fabrication.

6.3.3 NDT Personnel Qualifications

Nondestructive testing personnel shall be qualified under either of the American Society for Nondestructive Testing, Inc. (ASNT) documents referenced in Section 6.1.5.

NDT may be performed by NDT Level I personnel only under the close, direct supervision of an NDT Level II.

For welds in Seismic Weld Demand Categories A and B, UT may be performed only by UT technicians certified as Level II by their employer, or as ASNT Level III certified by examination by the ASNT, and have passed the Supplementary UT Inspector examination as described in Section 6.3.3.1.

6.3.3.1 Supplementary NDT Personnel Qualification Testing

Ultrasonic testing technicians who perform flaw detection or sizing shall be trained in applicable UT procedure and shall demonstrate their competence through testing as prescribed in Appendix E.

6.3.4 Bolting Inspector Qualifications

Bolting inspectors shall be trained and qualified to inspect bolting operations and high-strength bolted connections for compliance with the RCSC *Specification* and the Quality Assurance Plan. Competency shall be demonstrated through the administration of a written examination and through the hands-on demonstration by the Inspector of the methods to be used for bolt installation and inspection.

6.4 Contractor Tasks

The Contractor shall provide the management, personnel, equipment and services necessary to perform the Quality Control functions required in Sections 6.6, 6.7, 6.8, and 6.9.

6.5 Quality Assurance Agency Tasks

The Quality Assurance Agency shall provide the management, personnel, equipment and services necessary to perform the Quality Assurance functions required in Sections 6.6, 6.7, 6.8, and 6.9.

6.6 Welding Inspection

The welder, QC Welding Inspector, and QA Welding Inspector, as appropriate, shall perform the QC and QA tasks indicated in the following list, as amplified by Tables 6-1 and 6-2. Table 6-1 assigns a Process and Visual Inspection Welding Category for each welded joint, depending on the Seismic Weld Demand and Consequence Categories for the joint indicated on the design drawings. Table 6-2 indicates the specific actions required of the welder, QC Welding Inspector and QA Welding Inspector for joints of each Process and Visual Inspection Welding Category.

This list shall not be considered exclusive of any additional inspection tasks that may be necessary to meet the requirements of the codes or the Quality Assurance Plan.

1. Review and understand the applicable portions of the specifications, the Contract Documents and the shop drawings for the project.
2. Verify that all applicable welder qualifications, welding operator qualifications and tack welder qualifications are available, current and accurate.
3. Require requalification of any welder, welding operator or tack welder who has, for a period of six months, not used the process for which the person was qualified.
4. Verify welder identification and qualification. Verify that any required supplemental welder qualification testing, if required for the joint, has been executed and that the welder has passed.
5. Verify that each welder has a unique identification mark or die stamp to identify welds.
6. Verify that all applicable Welding Procedure Specifications (WPSs), with Procedure Qualification Records (PQRs) as needed, are available, current and accurate.
7. Verify that an approved Welding Procedure Specification (WPS) has been provided and that each welder performing the weld has reviewed the WPS. A copy of the appropriate WPSs shall be available for each joint, although need not be present at each joint location.
8. Review mill test reports for all main member and designated connection base material for compliance with the project requirements.
9. Verify base material identification with the approved shop drawings and specifications.
10. Verify the electrode, flux and shielding gas certifications for compliance with the Contract Documents.
11. Verify welding consumables with the approved shop drawings and approved WPSs.
12. Verify that electrodes are used only in the permitted positions and within the welding parameters specified in the WPS.
13. Verify that electrodes and fluxes are properly stored, and that exposure limits for the welding materials are satisfied.
14. At suitable intervals, observe joint preparation, assembly practice, preheat temperatures, interpass temperatures, welding techniques, welder performance and any postweld controlled cooling or heat treatment to ensure that the applicable requirements of the WPS and Code are satisfied.
15. At suitable intervals, verify proper current and voltage of the welding equipment in application of the WPS, if needed, by using a hand held calibrated amp and volt meter. Current and voltage shall be measured near the arc with this equipment.

16. Inspect the work to ensure compliance with *AWS D1.1* or the specified weld acceptance criteria. Size and contour of welds shall be measured with suitable gauges. A strong light, magnifiers, or other devices as needed may be used to aid visual inspection.
17. Schedule NDT technicians in a timely manner, after the visual inspection is complete and the assembly has cooled. The final NDT on a specific weld shall not be performed sooner than 24 hours after the welding has been completed. See Section 6.7.3.
18. Mark the welds, parts, and joints that have been inspected, and accepted, with a distinguishing mark or die stamp, or maintain records indicating the specific welds inspected by each inspector.
19. Document the accepted and rejected items in a written report. Transmit the report to the designated recipients in a timely manner.

Commentary: The Engineer must indicate the appropriate Seismic Weld Demand Category and Seismic Weld Consequence Category for each welded joint, on the design drawings. FEMA 350 and FEMA 351 specify the appropriate categories for welded joints in prequalified moment resisting connections. Part II of this document provides guidelines for assigning Seismic Weld Demand and Seismic Weld Consequence categories.

Table 6-1 Process and Visual Welding Inspection Categories

Seismic Weld Consequence Category	Seismic Weld Demand Category		
	A	**B**	**C**
H	1	1	2
M	1	2	3
L	2	3	3

6.7 Nondestructive Testing of Welded Joints

6.7.1 Magnetic Particle Testing

For welds classified into Seismic Weld Demand Categories in the design documents, Magnetic particle testing (MT) shall be conducted by the Quality Assurance Agency at the frequency designated in Table 6-3. MT shall be performed in accordance with the requirements of *AWS D1.1*, the ASTM standards referenced in Section 6.1.3 of this specification, and the provisions of Appendix F.

6.7.2 Ultrasonic Testing

For welds classified into Seismic Weld Demand Categories in the design documents, Ultrasonic testing (UT) shall be conducted by the Quality Assurance Agency for the percentage of joints designated in Table 6-3. UT shall be performed in accordance with the requirements of *AWS D1.1*, and the ASTM standards referenced in Section 6.1 of this specification.

Table 6-2 Process and Visual Welding Inspection Tasks

Process and Visual Welding Inspection Category:		1				2				3			
Inspection Tasks	Welder	Inspector											
		QC		QA		QC		QA		QC		QA	
		H	O	H	O	H	O	H	O	H	O	H	O
Inspection Prior to Welding													
Proper WPS selected for joint detail	✓	✓		✓		✓			✓		✓		✓
Proper welding materials selected	✓	✓		✓		✓			✓		✓		✓
WPS settings (voltage, polarity, current, wire feed speed) on welding equipment verified	✓	✓			✓✓		✓		✓		✓		✓
Shielding gas type (if used) verified	✓	✓			✓		✓		✓		✓		✓
Shielding gas flow rate setting verified	✓	✓			✓		✓		✓		✓		✓
Fit of backing bar (if used) acceptable	✓	✓			✓		✓		✓		✓		✓
Measure root opening	✓		✓		✓		✓		✓		✓		✓
Measure groove angle	✓		✓		✓		✓		✓		✓		✓
Verify above dimensions within joint tolerance and WPS tolerance	✓	✓			✓		✓		✓		✓		✓
Mark root edge location on beam flange for UT inspection (if required)	✓	✓			✓		✓		✓		✓		✓
Condition of steel surface acceptable	✓	✓			✓		✓		✓		✓		✓
Existing tack welds clean and of adequate quality	✓	✓			✓		✓		✓		✓		✓
Wind velocity within limits	✓		✓		✓		✓		✓		✓		✓
Weld joint surfaces free of discontinuities	✓		✓		✓		✓		✓		✓		✓
Minimum preheat required applied and verified	✓		✓✓		✓✓		✓		✓		✓		✓
Maximum preheat verified	✓		✓✓		✓✓		✓		✓		✓		✓
Observation of welder's inspection	✓		✓✓		✓		✓		✓		✓		✓
Observation of QC inspection					✓✓		✓		✓				✓

See Legend and Notes at the end of the table.

Table 6-2 Process and Visual Welding Inspection Tasks (Continued)

Process and Visual Welding Inspection Category:		1				2				3			
Inspection Tasks	Welder	Inspector											
		QC		QA		QC		QA		QC		QA	
		H	O	H	O	H	O	H	O	H	O	H	O
Inspection During Welding													
WPS followed (voltage, current, wire feed speed, travel speed, stickout, gas flow rate, pass location)	✓		✓✓		✓✓		✓✓		✓		✓		✓
Welding materials exposure control maintained	✓		✓✓		✓✓		✓✓		✓		✓		✓
Minimum interpass temperature maintained and verified	✓		✓✓		✓✓		✓✓		✓		✓		✓
Maximum interpass temperature verified	✓		✓✓		✓✓		✓✓		✓		✓		✓
No detrimental change in environmental conditions	✓		✓		✓		✓		✓		✓		✓
Tack welds do not crack during welding	✓		✓		✓		✓		✓		✓		✓
Each pass cleaned	✓		✓		✓		✓		✓		✓		✓
Each pass within profile limitations	✓		✓		✓		✓		✓		✓		✓
Each pass meets quality requirements	✓		✓		✓		✓		✓		✓		✓
Proper technique used (electrode angle, stringer beads)	✓		✓		✓		✓		✓		✓		✓
NDT in process, when required	✓	✓		✓		✓		✓			✓		✓
Observation of welder's inspection			✓		✓		✓		✓		✓		✓
Observation of QC process					✓				✓				✓

See Legend and Notes at the end of the table.

Table 6-2 Process and Visual Welding Inspection Tasks (Continued)

Process and Visual Welding Inspection Category:		1				2				3			
Inspection Tasks	Welder	Inspector											
		QC		QA		QC		QA		QC		QA	
		H	O	H	O	H	O	H	O	H	O	H	O
Inspection after Welding													
Welder identification legible	✓	✓		✓		✓		✓		✓			✓
Inspection delay period satisfied		✓		✓		✓		✓		✓		✓	
Weld cleaned	✓	✓		✓		✓		✓		✓		✓	
Weld size and length verified	✓	✓			✓	✓			✓	✓			✓
Weld within profile limitations	✓	✓			✓	✓			✓	✓			✓
Weld appearance indicates thorough fusion	✓	✓		✓		✓		✓		✓			✓
Weld craters acceptable	✓	✓			✓	✓			✓	✓			✓
Undercut within limitations	✓	✓		✓		✓		✓		✓			✓
Porosity within limitations	✓	✓			✓	✓			✓	✓			✓
Weld free of cracks	✓	✓		✓		✓		✓		✓			✓
Backing bars removed (if required)	✓	✓		✓		✓		✓		✓			✓
Weld tabs removed (if required)	✓	✓		✓		✓		✓		✓			✓
Surface finish (grind, contour) as required	✓	✓		✓		✓		✓		✓			✓
Observation of welder's inspection			✓		✓	✓	✓		✓		✓		✓
Observation of QC process					✓				✓				✓
NDT completed		✓		✓		✓		✓		✓		✓	

See Legend and Notes at the end of the table.

Table 6-2 Process and Visual Welding Inspection Tasks (Continued)

Legend:	
✓	The welder or Inspector, as noted, should perform this function, with measurements as necessary.
✓✓	The Inspector should observe these operations more frequently.
H	Hold – The welder shall not proceed with welding until inspection of this item is performed by the designated Inspector. After this inspection, the welder may proceed with welding until completion, with observation of welding functions on a random, periodic basis by the Inspector. For inspection after welding, this inspection must be performed prior to final acceptance of the item.
O	Observe – The welder may proceed with welding after completing his / her own inspection. The Inspector shall perform random, daily, periodic inspection and observation of these welding functions.
Notes:	
1.	The precise level and frequency of observation by either QC or QA is not specified. Inspection frequency shall be adequate to provide reasonable confidence in the control of the welding process and the quality of the completed welds. Consideration shall be made of the consistency achieved in satisfying the required welding parameters, and the effect of the welding parameter upon weld quality and performance.
2.	As a minimum, the observation inspection tasks listed shall be performed on a daily basis.
3.	Hold point inspections for WPS selection and welding materials need be performed only when changed by the welder.
4.	This list shall not be considered exclusive of any additional inspection tasks that may be necessary to meet the requirements of the codes or the Quality Assurance Plan.

6.7.3 NDT Delay Periods

Final visual inspection may take place immediately upon cooling to ambient temperature. Final nondestructive testing, either MT or UT, may not begin until 24 hours after the completion of welding. If delayed cooling such as insulating blankets or PWHT has been used, the 24-hour delay period shall begin after the steel has reached ambient temperature.

At the Contractor's option, Contractor Quality Control NDT may be performed before the delay period has expired, but shall not be used for final acceptance. In-process MT, such as for verifying the removal of cracks and other discontinuities when backgouging or repairing thermal cut surfaces, may be performed immediately upon completion of the welding or backgouging. No cooling period is necessary. Final MT and UT of the joint or repair shall not be performed until the 24-hour delay period is met. Final MT of weld tabs may be performed immediately upon completion.

6.7.4 Nondestructive Testing Requirements

The NDT technician shall perform all NDT, other than visual, required by the Quality Assurance Plan, Contract Documents and Building Code. NDT shall be performed in a timely manner, so as not to hinder production, and to detect welding problems soon after occurrence so that corrective measures may be taken by the Contractor to rectify such problems.

The NDT technician shall mark the welds, parts, or joints that have been inspected and accepted with a distinguishing mark or die stamp, or maintain records indicating the specific welds inspected.

The accepted and rejected items shall be documented in a written report. The report shall be transmitted to the designated recipients in a timely manner.

6.7.4.1 Heavy Sections

Heavy Section column flanges located at welded moment-resisting connections shall be ultrasonically examined, prior to welding, for evidence of laminations, inclusions or other discontinuities in accordance with ASTM A435, *Straight Beam Ultrasonic Examination of Steel Plates*, or ASTM A898, *Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes*, as applicable. The area to be tested is a zone 3 inches above and below each beam flange connection. For plates, any discontinuity causing a total loss of back reflection that cannot be contained within a circle the diameter of which is 3 inches, or one-half the plate thickness, whichever is greater, shall be rejected. For shapes, *ASTM 898* Level I criteria is applicable.

If moment connections are made to the weak axis of a wide flange column, the column web shall be similarly examined to the above criteria.

6.7.4.2 Lamellar Tearing

After joint completion, base metal thicker than 1-1/2 inches, in Seismic Force Resisting System joints where subject to through-thickness shrinkage strains from welding, and where UT is required by Table 6-3, shall be ultrasonically tested for discontinuities behind and adjacent to such welds. Any lamellar tearing discontinuities shall be accepted or rejected on the basis of criteria established by the Engineer or designated registered design professional in responsible charge of the work for that specific joint.

6.7.4.3 Column Splices

CJP and PJP groove welded column splices that are a part of the Seismic-Force-Resisting System, and are subject to applied tension under lateral loading, shall be ultrasonically tested as a QA Category BH/T weld. Those splices not subjected to applied tension from lateral loading, need not be ultrasonically tested.

> *Commentary: Since the Contractor can not determine which column splices may be subject to applied tension under lateral loading, the Engineer should indicate these splices on the design drawings. The determination as to whether a splice is under tension should be made considering load combinations with seismic loads amplified by the overstrength factor, W_0, in accordance with FEMA-302.*

Table 6-3 Nondestructive Testing Requirements

Seismic Weld Consequence Category		Seismic Weld Demand Category A	Seismic Weld Demand Category B	Seismic Weld Demand Category C
	H	**CJP** MT 100% of joints, full length UT 100% of joints, full length **PJP, fillets** MT 100% of joints, full length	**CJP** MT 100% of joints, full length if transversely loaded, partial length if longitudinally loaded UT 100% of joints, full length if transversely loaded, partial length if longitudinally loaded (Reduce UT to 25% of joints, of length as above, with low reject rate) **PJP, fillets** MT 25% of joints, full length if transversely loaded, partial length if longitudinally loaded	**CJP** UT 10% of joints, full length if transversely loaded, partial length if longitudinally loaded **PJP, fillets** MT 10% of joints, 6" spot at random
	M	**CJP** MT 100% of joints, full length UT 100% of joints, full length (Reduce UT to 25% of joints, full length, with high acceptance rate) **PJP, fillets** MT 100% of joints, full length	**CJP** MT 100% of joints, full length if transversely loaded, partial length if longitudinally loaded UT 100% of joints, full length if transversely loaded, partial length if longitudinally loaded (Reduce UT to 25% of joints, of length as above, with low reject rate) **PJP, fillets** MT 25% of joints, full length if transversely loaded, partial length if longitudinally loaded	No NDT required
	L	**CJP** MT 25% of joints, full length UT 25% of joints, full length **PJP, fillets** MT 10% of joints, 6" spot at random	**CJP** UT 10% of joints, full length **PJP, fillets** MT 10% of joints, 6" spot at random	No NDT required

Notes:

- UT is required only when the weld throat is 5/16" or greater.
- Reduce the rate of UT, where noted, if after 40 welds have been inspected, an individual welder's reject rate is less than 5%.
- Partial length testing is applicable for longitudinally loaded welds when over 24 inches in length. Inspect the beginning and end of each weld for a 6 inch length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches on either side of the stop/start location, and a 6 inch length for every 10 feet for a given weld.
- For column splices, see Section 6.7.4.3.

6.7.4.4 Column Webs at Continuity Plates

After welding continuity plates, test column webs for cracking using liquid penetrant testing (PT) or magnetic particle testing methods over a 3 inch minimum zone above and below continuity plates.

6.7.4.5 Column Webs at Doubler Plates

Doubler plates that are welded to the column at the intersection of the column web and flange, either on the radius or in the column "k-area", shall have the weld termination areas and adjacent column web inspected using magnetic particle testing or liquid penetrant testing (PT).

Column doubler plates that are welded only to the column flange need not have the column web inspected using nondestructive testing.

6.7.4.6 Weld Access Holes

Weld access holes shall be inspected using magnetic particle testing or liquid penetrant testing (PT) for base metal cracks and cracks from thermal cutting if the member is a part of the Seismic Force Resisting System framing, regardless of member size, or designated as a Heavy Section.

If a welded repair has been performed, magnetic particle testing shall be performed in the area immediately adjacent to the welded repair area.

6.7.4.7 Reduced Beam Section Repairs

If repairs to the Reduced Beam Section cut surface are performed by welding, the repair weld and immediately adjacent area shall be inspected using magnetic particle testing.

> *Commentary: This section only applies to moment-resisting connections employing prequalified Reduced Beam Section details. Refer to FEMA-350 for prequalification details.*

6.8 Bolting Inspection

The Bolting Inspector, whether designated QC or QA, shall complete the following items:

1. Review and understand the applicable portions of the specifications, contract drawings, shop detail drawings and erection plans for the project.
2. Review all manufacturer certifications for material compliance with the project requirements.
3. Verify bolting material identification.
4. Verify suitable, controlled storage conditions.
5. Verify that all applicable bolt installation procedures are available, current and accurate.

6. Verify that the appropriate bolt installation procedure has been provided and reviewed by each bolting crew member performing the work.
7. Observe the pre-installation testing performed at the start of the work for each assembly lot.
8. For the calibrated wrench method of installation, observe calibration of the wrench(s) at the start of each work shift.
9. Verify the suitability of the bolted joints, such as bolt hole size and condition, prior to assembly. Check for unfair reaming or slotting of poorly aligned holes.
10. For slip-critical joints, verify that the required faying surface conditions are met.
11. Prior to pretensioning, verify that all bolts have been installed and the joint brought to the snug tight condition.
12. For pretensioned joints, routinely observe, at suitable intervals, the pretensioning operations to verify the proper application of the bolting procedures.
13. Arbitrate any disputes regarding achieved bolt pretension immediately upon installation of the bolts in dispute.
14. Complete a written report recording the joints observed, inspected, and accepted. The report shall be transmitted to the designated recipients in a timely manner.

6.9 Shear Stud Welding Inspection

Periodically, the stud welding shall be inspected and tested in accordance with *AWS D1.1* Section 7, including the following:

1. Witness or review stud base qualification testing, as needed.
2. Witness welding operator qualification testing.
3. Witness or review pre-production testing and qualification.
4. Periodically, inspect welding and perform verification inspection and testing.

6.10 Special Inspection

The Special Inspector shall perform the following inspection tasks, if so designated in the Quality Assurance Plan.

1. Ascertain that all material complies with the Contract Documents, either by material and product certifications and/or by testing.
2. Evaluate the Contractor's QC program and its effectiveness.
3. Verify that the fabricator is properly implementing the fabrication procedures and quality control procedures.
4. Verify the qualifications of the QC and QA Inspectors and the NDT technicians.

5. Inspect the steel frame to verify compliance with the details shown on the approved construction documents, such as bracing, stiffening, member locations and proper application of joint details at each connection.
6. Verify that all fabrication and erection, including welding and bolting, is performed in accordance with the Contract Documents.
7. Keep written records of the inspections performed.
8. Distribute copies of written records to the Owner, Engineer, Contractor and/or Building Official, as specified in the Quality Assurance Plan. Records documenting correction of nonconformance shall be distributed to the same organizations as those receiving reports of nonconformance.
9. Upon completion of the Inspector's tasks, issue a written report stating that all work inspected under the Inspector's charge meets the applicable codes and specifications, and that nonconformances have been corrected or resolved to the satisfaction of the Engineer or other persons in responsible charge.